From:	Jonna Mazet <jkmazet@ucdavis.edu>
To:	Matt Blake <mblake@ucdavis.edu>;Eunah Regina Cho <eecho@ucdavis.edu>;kburns@ucdavis.edu <kburns@ucdavis.edu>
Sent:	6/4/2018 7:18:36 AM
Subject:	Fwd: Kudos to PREDICT: input on India Nipah story

FYI,
J

---------- Forwarded message ----------
From: **Andrew Clements** <aclements@usaid.gov>
Date: Mon, Jun 4, 2018 at 12:02 AM
Subject: Kudos to PREDICT: input on India Nipah story
To: Jonna Mazet <jkmazet@ucdavis.edu>, William Karesh <Karesh@ecohealthalliance.org>, bhbird@ucdavis.edu, djwolking@ucdavis.edu, daszak@ecohealthalliance.org
Cc: Jon Epstein <epstein@ecohealthalliance.org>, predictmgt@usaid.gov

The last article is the best one I've seen so far because it's based on actual science and includes perspective from Jon Epstein.

Thanks to PREDICT for proactively injecting some much-needed truth into news articles on this outbreak that have otherwise been less than impressive.

Andrew P. Clements, Ph.D.
Senior Scientific Advisor
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: 1-571-345-4253
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Begin forwarded message:

From: promed-edr@promedmail.org
Date: June 2, 2018 at 7:47:38 PM GMT+2
To: promed-post@promedmail.org, promed-edr-post@promedmail.org, promed-ahead-post@promedmail.org
Subject: PRO/AH/EDR> Nipah virus - India (10): (KL)
Reply-To: promedNOREPLY@promedmail.org

NIPAH VIRUS - INDIA (10): (KERALA)
****
A ProMED-mail post
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International Society for Infectious Diseases
<http://www.isid.org>

Nipah virus - India (10): (KL)
NIPAH VIRUS - INDIA (10): (KERALA)

In this update:
[1] New fatality, Kerala
[2] Kerala details
[3] WHO review
[4] Virus strains

[5] Bat reservoirs

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[1] New fatality, Kerala
Date: Fri 1 Jun 2018 11:51
Source: The News Minuste [edited]
<https://www.thenewsminute.com/article/nipah-virus-death-toll-rises-17-fresh-case-confirmed-kozhikode-82271>

A total of one more person confirmed to have contracted the Nipah Virus infection passed away in Kerala, taking the death toll to 17. The deceased, who hails from Naduvannur, was earlier tested negative for the virus. His results came back positive after a 2nd test.

According to reports, this case had been shifted to Kozhikode Medical College on 26 May [2018] from Balussery Taluk Hospital following severe fever and symptoms of Nipah [virus infection]. He is reported to have been in the list of those who were in contact with the 1st victims of Nipah. He is believed to have contracted the infection from another person who succumbed to the virus, while they were admitted at the Balussery hospital. The earlier case passed away on [Sun 20 May 2018].

On [Wed 23 May 2018] 2 people - one 55 and the other 28, a native of Karassery, who had contracted the deadly virus passed away in the Kozhikode Medical College where they were undergoing treatment.

The 55-year-old, who worked as a senior superintendent at a district court in Kozhikode, is reported to have gotten the infection at Kozhikode Medical College. Authorities are yet to trace the source of infection of the other patient.

Suspecting a 2nd wave of the infection, the authorities have scaled up the number of people, who are under observation for Nipah virus [infection] to 1407.

Meanwhile, the medicines from Australia to fight the Nipah Virus - M 102.4 human monoclonal antibody, arrived in Kozhikode on [Thu 31 May 2018] night and will be administered to patients as per the treatment protocol.

A soldier died in Kolkata of suspected Nipah virus infection, a Defence spokesman said on [Wed 30 May 2018].

The soldier, who hails from Kerala and posted at the Eastern Command headquarters Fort William, was admitted to the Command Hospital in Kolkata on [Sun 20 May 2018] and passed away on [Fri 25 May 2018], the spokesman said. The soldier had been on a month's leave to Kerala before rejoining duty on [Sun 13 May 2018]. His body fluids have been sent to the National Institute of Virology in Pune which is the only agency in the country to certify whether it was a case of Nipah Virus or not. "Till such time the report from the NIV in Pune is received, it cannot be confirmed whether it was a case of Nipah Virus or not," the spokesman said.

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Communicated by:
ProMED-mail Rapporteur Mary Marshall

[It is not clear why the initial test was negative but the 2nd was positive. The type of test used was not mentioned, nor when the 2nd test was conducted. Apparently, there has been nococomial transmission of the virus, indicating that greater isoation of suspected cases is needed.

Maps of India can be accessed at:
http://www.mapsofindia.com/maps/india/india-political-map.htm and
http://healthmap.org/promed/p/308;
Karnataka State, India: http://healthmap.org/promed/p/307. - Mod.TY]

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[2] Kerala details
Date: Fri 1 Jun 2018
Source: The Indian Express [edited]
<http://indianexpress.com/article/india/kerala-nipah-outbreak-large-health-squads-being-raised-contact-list-to-be-expanded-as-toll-touches-16-5200111/>

At the start of this week [week of Sun 27 May 2018], there was a relative calm in the corridors of the state's health department. The number of deaths resulting from the outbreak of the Nipah virus infection had stabilised at 13, with 2 others undergoing treatment at the Kozhikode Medical College showing signs of recovery.

More than 150 blood and fluid samples of suspected patients sent for testing had come back negative and there were no new positive cases. Health officials and doctors had heaved a sigh of relief believing the storm had passed. But, with 3 more deaths reported in the last 2 days, Kozhikode and its adjoining district of Malappuram have once again sunk into a state of consternation.

As per the latest figures of the health department updated as of [Thu 31 May 2018] evening, 16 patients have now succumbed to the virus [now increased to 17], excluding the 1st victim whose samples were never sent for testing. He is believed to be the 'index' case from whom the virus spread but since his death occurred before the samples could be sent for testing, it was never confirmed by medical officials.

A total of 18 cases have been deemed positive for the virus, with 14 in Kozhikode and 4 in Malappuram district. Out of a total of 196 fluid samples sent for testing to National Institute of Virology in Pune, 178 samples have come back negative. As of [Thu 31 May 2018] evening, a total of 11 people are under observation and being routinely checked for any signs of the virus.

The health department on [Fri 1 Jun 2018] issued an advisory asking those who were at the Medical College in Kozhikode visiting the casualty, CT scan room and waiting room on [Mon 14 May 2018] between 10 am and 5 pm to immediately contact the state Nipah cell for directions. It also asked those who visited the Balussery Taluk Hospital on [Fri 18 and Sat 19 May 2018] till 2 pm to do the same. Those, who were in contact with the deceased on [Wed 30 and Thu 31 May 2018], must also get in touch with the Nipah cell, the department

said.

Till now, health officials were under the impression that the point of contact between the infected and ordinary patients was limited to the Medical College and the Perambra Taluk Hospital, where the 1st victim was initially admitted. But now, the surveillance has been extended to the Balussery hospital as well, where the 25-year-old man, the latest victim, was 1st admitted. With his death, the health department has realised that it has to substantially expand the contact list and bring more people, who may have been in contact at these hospitals at those specific hours, into it.

Contact list widens beyond govt's expectations, large health squads being raised

A senior health official, requesting anonymity, said the recent death a truck driver, who is believed to have contracted the infection from the 'index' case at the casualty ward of the Medical College, has given the health department reason to worry. The truck driver's name was never present in the 'contact' list of those who were in close touch with the earlier deceased. But officials say he had visited the casualty section of the Medical College when he was a bystander for another patient, around the same time the 'index' case visited the hospital.

"Initially, our contact list had around 800 persons, but now after the truck driver's death, the list has expanded beyond our expectations. So the department is now raising large health squads with officials from the panchayat and revenue teams to individually monitor these people. It is a huge task. We will 1st divide these contacts based on high-risk and low-risk. Then we will use our resources to individually contact them and ask them about their conditions. If they report any sort of uneasiness in the last few days, then we can get them to the hospital right away," he said.

It is clear that the source of the outbreak originated from the family who resided in Soopikada in Changaroth panchayat. The 1st suspected victim of the virus (suspected because his sample was never tested) was a 23-year-old, who may have come in contact with an infected fruit-bat, considered the natural carriers of the NiV. While that man, initially admitted to Perambra taluk hospital, passed away on [Sat 5 May 2018], his elder brother and his paternal aunt too died in quick succession in the 3rd week of May. It was these deaths, all within the same family, that sparked concerns in the health department and prompted them to send samples for testing, all of which came back positive. Last week [week of Sun 20 May 2018], the 3rd death in the family occurred when one, who had been put on ventilator at the Medical College, also passed away.

A senior doctor, a member of the core team, confirmed to India Express that all except one of the 16 casualties had contracted the virus through primary contact with any of the members of the involved family. These transmissions are likely to have taken place either at the Perambra hospital or the Medical College's CT scan area, the ICU and the corridors of the radiology department. Some cases include a nurse who had taken care of 2 of the victims as well as a 3rd who had been admitted.

Only the latest victim is believed to have got [the virus] transmitted from a secondary contact -- one of the earlier victims of the virus. It is being suspected that both men had slept on beds beside each other at the hospital in Balussery. While the other was admitted to the Medical College [hospital] on [Thu 31 May 2018] with symptoms of encephalitis; he died the same day.

"Every unnatural death needs to be investigated. We were able to make early diagnosis and early detection, but it is true that the surveillance and measures to contain the infection especially at the Medical College should have been strengthened," an official admitted. "Infection progresses fast leaving little time for recovery".

Dr G Arunkumar, head of the Department for Virus Research at Manipal, said the strain of virus detected in Kerala is very similar to the cases found in Bangladesh. "Our preliminary analysis suggests that the strain found here is closer to the Bangladeshi virus strain, almost 98 percent similar. The Bangladeshi strain had a much higher mortality rate than the strain which was 1st discovered in Malaysia," he said.

With only 2 patients, who were tested positive for the virus, recovering, the mortality rate in Kerala has been a shocking 90 percent. Even though the incubation period is quite long, ranging from 4 days to 21 days, sometimes even extending in rare cases to 60 days, the rate of the spread of the infection is very fast, leaving little time for the patient to recover. Death, in most cases, happens due to cerebral haemorrhage.

"By the time we identify the case, the recovery period may be less," he added. However, Dr Arunkumar stressed that there is no need to panic as the infection has not gone out of control. "It is still under our control because it has not gone into the community. We need to identify and detect new cases whenever they come," he said.

[Byline: Vishnu Varma]

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Communicated by:
ProMED-mail
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[It is interesting, but perhaps not surprising, that the Nipah virus strains involved in this outbreak are similar to those from Bangladesh. The source of virus of this Kerala outbreak is likely to be giant fruit bats (in the genus _Pteropus_) as it is in Bangladesh. The bats can move long distances and can cross international borders. - Mod.TY]

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[3] WHO review
Date: Thu 31 May 2018
Source: WHO Emergencies preparedness, response [edited]
<http://www.who.int/csr/don/31-may-2018-nipah-india/en/>

Nipah virus - India

On [Sat 19 May 2018], 3 deaths due to Nipah virus infection were reported in Kozhikode District, Kerala State, India. The 3 deaths occurred in a family cluster and a 4th death was subsequently reported in a health care worker who was involved in treatment of the family in the local hospital. Laboratory testing of throat swabs, urine and blood samples collected from 4 suspected patients has been conducted by the National Institute of Virology in Pune; 3 of the 4 reported deaths were confirmed positive for Nipah virus (NiV) by real-time polymerase chain reaction (RT-PCR) and IgM Elisa for NiV.

The field investigation team found bats living in the abandoned water well on the premises of a new house where the family had plans to move after renovation. One bat was caught and sent to the National Institute of Virology, Pune for laboratory testing. [These were insectivorous bats and unlikely reservoirs of the virus. - Mod.TY]

As of 28 May 2018 and since the beginning of the outbreak, as a result of further investigations and contact tracing, 15 people have tested positive for NiV in Kozhikode and Malappuram districts, Kerala State. Of the 15 laboratory-confirmed cases, 2 are hospitalized and 13 have died, including the health care worker who was involved in treatment of the deceased. As of 28 May [2018], 13 deaths have been reported: 3 from Malappuram District and 10 from Kozhikode District. One deceased case, the index case, could not be tested but was epidemiologically linked to a confirmed case. There are 16 suspected cases identified through contact tracing who are under observation while their laboratory results are pending and at least 753 additional people, including health care workers, under observation. Laboratory testing is being conducted by the Manipal Institute of Virus Research and the National Institute of Virology, Pune; both laboratories have advanced capacity for RT-PCR.

In the current outbreak, acute respiratory distress syndrome and encephalitis have been observed.

This is the 1st NiV outbreak reported in Kerala State and 3rd NiV outbreak known to have occurred in India, with the most recent outbreak reported in 2007.

Public health response

Government response:
- A multi-disciplinary central team from the National Centre for Disease Control was sent to Kerala to investigate and respond. Contact tracing has been initiated. Infection prevention and control measures have been strengthened in health facilities.
- Acute fever and acute encephalitis syndrome (AES) surveillance have been enhanced across the state. Hospital and community surveillance have also been strengthened in Kerala.
- The Virus Research Diagnostic Laboratory at Manipal Hospital and the National Institute of Virology are conducting laboratory testing to confirm cases.
- The government is coordinating with all relevant sectors including zoonosis, wildlife, animal husbandry, human health, clinicians, pulmonologists, neurologists and private sector.
- Risk communication messages are being delivered to the community,

public, stakeholders, and partners. The Ministry of Health and Family Welfare (MoHFW) has shared guidelines drafted by the National Centre for Disease Control with states and relevant stakeholders and also posted them on the MoHFW website.

WHO response:
- WHO is in contact with national authorities and continues to closely monitor this event.
- At the request of the MoHFW, WHO has shared materials, especially risk communication materials on Nipah virus, including those used in Bangladesh.
- The MoHFW is conducting preliminary investigations and may request that WHO support the response.
- The MoHFW is coordinating a multi-dimensional investigation and may request support from WHO.

WHO risk assessment

NiV infection is an emerging zoonotic disease of public health importance in the WHO South-East Asia Region with a high case fatality rate estimated to be between 40 and 75 percent; however, this rate can vary by outbreak depending on local capabilities for epidemiological surveillance and clinical management. NiV was 1st recognized in 1998-1999 during an outbreak among pig farmers in Malaysia and Singapore. No subsequent outbreaks have been reported in Malaysia or Singapore since 1999. NiV was 1st recognized in India and Bangladesh in 2001; since then, nearly annual outbreaks have occurred in Bangladesh. The disease has been identified periodically in eastern India (2001, 2007).

Limited human-to-human transmission of NiV can occur among family members and health workers who treat infected patients. Large fruit bats of the genus _Pteropus_ are the natural reservoirs of NiV and given the wide distribution of the species and migration of the locally-abundant fruit bats in India, the risk of exposure to NiV is high. Nevertheless, previous outbreaks in affected countries have had a strong seasonal pattern and a limited geographical range.

Possible routes of transmission for this outbreak include consumption of fruits partially eaten by the bats, exposure to the virus by bats or human-to-human transmission through unprotected close contact in the community or hospital. Many cases identified in the current outbreak were infected through direct unprotected contact with other infected persons.

Given that India has faced and contained Nipah virus outbreaks before, the country has the capacity to rapidly respond and verify cases with laboratory testing. At the moment, the outbreak is localized and WHO assesses the risk to be low at the national and regional levels.

WHO advice

Currently, there are no specific treatments available for Nipah virus disease and care is supportive. Intensive supportive care is recommended to treat severe respiratory and neurologic complications.

NiV infection can be prevented by avoiding exposure to sick pigs and

bats in endemic areas, and by avoiding consuming fruits partially-eaten by infected bats or drinking raw date palm sap/toddy/juice.

In health care settings, staff should consistently implement standard infection prevention and control measures when caring for patients to prevent nosocomial infections. Health care workers caring for a patient suspected to have NiV fever should immediately contact local and national experts for guidance and to arrange for laboratory testing.

Research is needed to better understand the ecology of bats and NiV.

WHO advises against the application of any travel or trade restrictions on India based on the information currently available on this event.

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Communicated by:
ProMED-mail Rapporteur Marianne Hopp

[This outbreak is moving along fast enough that the WHO numbers of fatalities and individuals under observation are out-of-date. However, the responses, risk assessments and advice are of interest. The government has asked people to "stop consumption of raw date palm sap" and take special precaution when it comes to consuming mangoes that have fallen off trees and lying under them this season (<https://timesofindia.indiatimes.com/city/delhi/nipah-virus-scare-delhi-government-asks-people-to-be-careful-in-consuming-fruits/articleshow/64405317.cms>).
- Mod.TY]

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[4] Virus strains
Date: Wed 30 May 2018 08:25 IST
Source: The Times of India [edited]
<https://timesofindia.indiatimes.com/city/pune/nipah-outbreak-in-kerala-traced-to-bangladesh-strain-of-virus/articleshow/64378311.cms>

Scientists at the National Institute of Virology (NIV) have confirmed that the Bangladesh strain of Nipah virus (NiV) is responsible for the current outbreak in Kerala. They reached the conclusion after decoding the full genome of the virus drawn from the throat swab sample of an infected patient.

The Nipah virus has 2 strains -- Malaysia (NiVM) and Bangladesh (NiVB). Both the strains have high fatality rates, between 60 and 85 percent, the scientists said.

"Sequencing of the genetic make-up of the virus revealed that the Indian Nipah virus genome is genetically similar to the Bangladesh strain," senior scientist and NIV-Pune director Devendra Mourya told TOI on [Tue 29 May 2018]. Both the strains have more or less an equal mortality rate and are responsible for local outbreaks. "No study has so far proved that the Bangladesh strain is more lethal or pathogenic than the Malaysia strain," Mourya said.

Nipah [virus] was 1st reported in Bangladesh's Meherpur district as a cause of an outbreak of encephalitis in 2001. Since then, Nipah [virus] outbreaks have been reported almost every year in some districts of the neighbouring country. "Studies in Bangladesh have revealed that consumption of palm sap infected with bat urine and saliva was mostly responsible for the transmission of the infection from bats to humans and then humans to humans as well," NIV scientist Pragya Yadav said.

Since the outbreak of the virus earlier this month [May 2018], 13 people have died of Nipah [virus infection] in Kerala .

A central team comprising experts from the National Centre for Disease Control (NCDC), All India Institute of Medical Sciences (AIIMS) and the NIV has visited the Government Medical College in Kozhikode to understand gaps in the hospital's infection control measures and medical management. "Our specialized team is working with the central team on the field and also at the hospital to contain the outbreak. They are also working in and around houses of people diagnosed with the infection in the beginning to find the possible links of infection," Mourya said.

The samples of bats found in the well of a house in Perambra, considered the epicentre of the outbreak in Kerala, tested negative for the virus at the designated laboratory in Bhopal. "The bats whose samples were tested at the Bhopal lab were not fruit bats (_Pteropus giganteus_ [medius_]). This particular species is the only known reservoir for the virus to date," Mourya said.

[Byline: Umesh Isalkar]

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Communicated by:
ProMED-mail
<promed@promedmail.org>

[The timely response of health authorities in this outbreak has doubtless contributed to its limited spread. The response is a good example of epidemiological surveillance studies with contact tracking and rapid laboratory support as well as support of health care providers. - Mod.TY]

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[5] Bat reservoirs
Date: Thu 30 May 2018
Source: The Wire [edited]
<https://thewire.in/health/the-absence-of-evidence-for-nipah-in-fruit-bats-is-not-evidence-of-absence>

There has been much speculation over the source of the Nipah virus that triggered an outbreak in Kozhikode, Kerala. Last week [week of Sun 20 May 2018], the state animal husbandry department captured and tested insectivorous bats (_Megaderma spasma_) from a well in the compound belonging to a family whose members were the virus's 1st victims - and found no virus in them.

News reports have pointed out that the virus's reservoir is different:

fruit bats of the species _Pteropus medius_ (formerly _Pteropus giganteus_). A fresh effort is underway to capture and test fruit bats - but the delay could mean that the virus may not be found in them at all. Should this happen, it still wouldn't mean that bats were not the source of the virus.

This is because it is difficult to find a bat that is infected.

Bats "may only be infectious for a week or 2, and then they clear the virus and they're no longer infectious," said Jonathan Epstein, a veterinarian and epidemiologist at EcoHealth Alliance, New York, who has, for over a decade, studied Nipah outbreaks and the bats that cause them, in Malaysia, India and Bangladesh. "That's why these outbreaks are relatively rare events, given the fact that these bats are so abundant and so common but very few of them are ever actually shedding virus at a given time."

Epstein and others had conducted an experimental study of _Pteropus_ bats in 2011 and found that the time window in which the bats are capable of passing on the infection to other animals or humans is quite small. In fact, the virus can't be found in experimentally infected bats after a few weeks. The few bats in an infected population that could be shedding the virus may be doing so in low quantities and for a short duration.

"Finding that bats don't have Nipah virus at the time of sampling certainly doesn't mean that it didn't come from those bats, particularly _P. medius_," Epstein said. "The overwhelming abundance of evidence really shows that this bat is the reservoir for Nipah virus on the subcontinent in Bangladesh and in India."

The National Centre for Disease Control, which is involved in investigating the Kerala outbreak, is aware of this, too.

In Bangladesh, Nipah virus infections arise from consuming date palm sap contaminated by bat urine or saliva. On the other hand, the outbreak in Malaysia in 1998 was traced to pigs that ate fruits infected by bats; the pigs had then passed the infection on to humans. Domesticated animals sampled in the area of the Kerala outbreak have so far not been found to carry the virus.

It is possible that the virus may have arrived in Kerala in infected fruits, some of which the 1st victim might have consumed. But it's more likely that the virus has always been silently circulating in the wild.

Pteropus bats are known to be the reservoir species for the Nipah and the closely related Hendra viruses, collectively called henipaviruses. And evidence of a henipavirus infection has been found in _Pteropus_ bats in a wide region, from Australia to Madagascar. This, along with the fact that infected bats do not show any overt signs of illness, suggests that these bats have co-evolved with henipaviruses.

In India, fruit bats have been tested for the Nipah virus. A 2012 study by researchers from the National Institute of Virology, Pune, and the US Centres for Disease Control and Prevention had found the

virus in only one of 140 bats tested in Maharashtra and West Bengal. The other 139 bats were not found to have even the antibodies necessary to fight the virus. (The paper noted the need for a systematic survey to understand the Nipah virus's distribution.)

A 2008 paper had found that 20 of 41 bats tested in Haryana had antibodies to the Nipah virus. Apart from the difference in location, this disparity in the proportion of bats with antibodies to the virus is not surprising, according to Epstein.

"In Pteropid bats and _P. medius_ in particular, we find that there are different proportions of bats in any given colony exposed to the Nipah virus when we look," he said. This proportion is always changing, and what such surveys reveal will only be a snapshot.

In Kerala, the state department of animal husbandry has been criticised for having sampled insectivorous bats 1st. The bats had been captured from a well reportedly cleaned by the 1st victims of the virus before they had fallen ill. But this choice - seemingly done in a bid to allay public anxiety - and the negative result has now sowed confusion, with news reports claiming wrongly that bats have been proven to not be the source of the infection.

The virus's 1st victim (although he wasn't tested for it) died on [Sat 5 May 2018]. Since then, fruit bats in the area that may have been the source of the virus could have cleared the virus from their bodies.

"Depending on when bats are sampled, it really does make a difference as to whether we will or won't detect the virus," said Epstein. This delay, together with the fact that only a small number of bats in any given colony are infectious to begin with, means that it's possible the virus won't be found from fruit bats in the area.

One workaround is to sample a larger number of bats at a time. However, only 3 insectivorous bat samples from the well were tested, according to Scroll. The National Institute of High Security Animal Diseases in Bhopal, which is testing the samples, has now asked for 50 fruit bat samples. Further, the test results of samples displayed in the news report show that they were tested for viral genetic material, not antibodies. Arun Zachariah, of the Kerala Veterinary and Animal Sciences University, Wayanad, confirmed this. He had been involved in capturing the bats and collecting blood, urine, saliva and faecal samples. If deliberate, it's unclear why this choice of test was made.

Antibodies are easier to detect, and if Nipah antibodies are found in bats in the area, it would be evidence that the virus has indeed been circulating among them. (Bats are known to lose antibodies too, Epstein said, though the period over which this happens is unknown.)

Differences between various outbreaks
Analysis of Nipah outbreaks in Bangladesh between 2001 and 2007 suggests that there have been more than 20 instances of bat-to-human transmissions of the virus. In Malaysia in 1998, it seems there had been a single transmission from bat to pig, which was responsible for an epidemic that killed 105 people and led to the mass culling of pigs.

Animals - cattle and goats apart from pigs - in the vicinity of affected areas in Bangladesh were found to have antibodies to a virus similar to Nipah, and many humans infected in these outbreaks had had contact with sick animals. After the outbreak in Siliguri, West Bengal, by contrast, domestic animals were not tested to see if they could have been intermediate hosts - nor were bats.

Half the patients in the numerous outbreaks in Bangladesh had been infected by other people. The human-to-human transmission during the 2001 outbreak in Siliguri was also high, about 75 percent. The ratio was similarly high in the Kerala outbreak as well, with the 1st confirmed patient suspected to have acquired it from his brother, the latter died on [Sat 5 May 2018].

All known cases since then have either been family members of the index case, people who had had contact with him or those who had shared a hospital ward with others who had acquired the infection from him. Thus far, the virus has claimed 14 lives, with 3 more infected people in intensive care.

A more disastrous outbreak may have been averted partly because not all patients appeared to transmit the virus. In the 1998 outbreak in Malaysia, no confirmed case of human-to-human transmission was recorded, while in Bangladesh only 7 percent of patients had infected others.

There is another difference: the Malaysia strain of the virus caused neurological symptoms - below normal or absent reflexes, involuntary contractions of muscles, difficulty in eye movement - in humans. The Bangladesh and West Bengal strains (similar to each other) appeared to cause more severe respiratory symptoms in addition to neurological ones. Further, patients who had difficulty breathing had been found to be more likely to infect others.

Known unknowns

That not all Nipah-infected patients transmit the virus appears to be the case in the present outbreak in Kerala as well, according to observations made by G. Arunkumar of the Manipal Centre for Virus Research, Manipal. He noted that only patients in the disease's acute stage appeared to infect others.

Why this is so is unknown. "I think one of the things we're still working to learn in the scientific community," said Epstein, "is how the genetics of the virus translates into the clinical outcomes for patients in terms of how easily it spreads from person to person and how severe the disease is."

There remain other mysteries about the virus and its ecology. "Disease emergence," one paper noted, "is fundamentally an ecological process - the challenge is to identify the underlying drivers, and counter them."

We don't yet know what these drivers are. What are the mechanisms by which the virus is kept in circulation among bats? What are the particular factors that must occur together for the virus to "spill over" from bats to other animals or humans? To add to the mystery: an

individual bat that has cleared the infection may experience recrudescence - the virus may have been present all along, untraceably, and may reappear later and circulate in the otherwise healthy bat once again.

Regardless of whether bats in Kerala are found to carry the virus, culling them - which some news reports suggest might be underway - is not a solution.

"These bats, _P. medius_, are incredibly important ecologically in terms of pollination and seed dispersal," Epstein said. "In every case where there's a Nipah virus outbreak, the transmission from bats to humans is accidental - usually contamination of some type of food resource, whether it's date palm sap or fruit. And so this is really an opportunity for people to understand that we do share habitat and food with many different types of wildlife. But the answer is not to try to exterminate bats or to get rid of them."

[Byline: Nithyanand Rao]

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Communicated by:
ProMED-mail
<promed@promedmail.org>

[The report above provides an interesting and thorough overview of _Pteropus_ bats and their relationship to Nipah virus. One important point is that it is difficult to estimate the sample size needed to find positive individuals when the prevalence is low and the time that the virus is shed is limited. Their classic saying "The absence of evidence is not evidence of absence" applies to this situation, as it does to many others. This report has a dramatic image of _Pteropus medius_ and can be seen at the above URL. - Mod.TY]

[A map of Kerala State, India: <http://healthmap.org/promed/p/308>]

[See Also:
Nipah virus - India (09): (WB ex KL) susp.
http://promedmail.org/post/20180530.5829184
Nipah virus - India (08): (KR ex KL) susp.
http://promedmail.org/post/20180529.5826769
Nipah virus - India (07) http://promedmail.org/post/20180528.5822566
Nipah virus - India (06): (KL,KA)
http://promedmail.org/post/20180526.5819777
Nipah virus - India (05): (KL,TG)
http://promedmail.org/post/20180525.5817917
Nipah virus - India (04): (KL, KA)
http://promedmail.org/post/20180524.5815473
Nipah virus - India (03): (KL) conf.
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